Title: "A BALANCE WEIGHT, A WHEEL, A WHEEL RIM AND A WHEEL DISC"

The present invention relates to a wheel-balance weight for use on a vehicle wheel, a wheel made from stamped steel especially for use on an automotive vehicle, the wheel being provided with means to fix the weigh for a dynamic balancing of the wheel-tire assembly, as well as a wheel rim and a wheel disc thus configured.

Description of the Prior Art

The conventional wheels made from stamped steel are composed of a wheel rim and a wheel disc, the rim accounting for fixing the tire and comprising, at its end, a protuberant flange. In an alternative embodiment, the wheel from stamped steel comprises a flange that is an integral part of the disc. These protuberant flanges are substantially perpendicular to the rest of the body and have a substantially "]" or "J" shaped curved profile.

The flange enables one to place the wheel weight, the function of which is to balance the wheel-tire assembly dynamically, in order to prevent trepidation of a moving vehicle, particularly at a high speed, as a result of an unbalancing. The balance weight is basically constituted by a metal, more usually by a high-density lead or another metal, from which a substantially U-shaped clamp projects with a first end fixed to the metal body and a second end being free to cooperate with the flange, as will be described later.

In order to fix the wheel weight, it is positioned in a way to force its movement against the wheel, so that the opening of the U-shaped clamp will permit cooperation with the free end of the flange. As the weight is pressed against the wheel, the clamp gradually opens until the metal body touches the inner surface of the flange. The clamp tends to return to its natural shape, thus applying a force onto the tip of the flange, generating a normal force, maximizing the friction between clamp and flange tip, maintaining the weight stable in its position, even when rotational movement of the wheel occurs.

In the case of painted wheels, the friction provided by the U-shaped clamp is sufficient to maintain the weight in its position, even if the

vehicle travels at high speeds or on roads having imperfections. A drawback of the painted wheels is that, with the friction caused by the U-shaped clamp, the paining at the place of friction is damaged, from the moment of its installation, thus causing financial losses to the user if, for instance, he wants to sell the wheels in the near future, rust and devaluation of the vehicle.

On the other hand, the wheels made of stamped steel have the drawback of being aesthetically little attractive, being little used on luxury vehicles. With a view to solve this problem, the wheel of stamped steel has been developed with a chromed finishing, which provides a more attractive visual effect, making it commercially more acceptable. However, this chromed finishing causes a drop in the friction coefficient of the flange surface, where the clamp of the balance weight is fixed. The reduction in the friction coefficient causes the resultant friction force not to be sufficient for keeping the weight in the desired position, even if the installation is correct. The chances of the balance weight to detach from the wheel when the vehicle is traveling on a road having deformations are much higher, bringing a great drawback for the those who use this type of wheel.

US Pat. 6,238,006 discloses an attempt at eliminating these drawbacks, by disclosing a wheel provided with a recess for retaining the balance weight. This recess comprises a shoulder that serves as stop for projecting the balancing clamp, so that both of them will function as a lock.

Although this embodiment eliminates the mentioned drawbacks, it needs a specific balance weight, the clamp of which is provided with a projection for locking it close to the wheel, which renders its use and/or installation less attractive.

Another solution is proposed in US Pat. 5,733,016, which discloses a balance weight assembly on vehicle wheels, wherein the wheel comprises a flange provided with a concave recess and a balance weight provided with a U-shaped curvature at the free end of the clamp, which enables one to fit the clamp into the recess, so that it will be steadily fixed to the wheel. However, this embodiment still has the above-cited drawbacks.

Another drawback in the present embodiment of balance weights

is the massive utilization of lead in manufacturing them. Lead is a heavy metal, which causes diseases such as cancer and is an active environmental pollutant, so that the use thereof has already been discussed. In this regard, the European Community Committee has established a time limit for the manufacturer of balance weight to discontinue the use of lead, mainly because the process of making it is a polluting element. For vehicles having an already advanced project, the time limit is July 1st, 2003, and for maintaining the vehicles in circulation the time limit is July 1st, 2005. In view of the time limits already approved by the European Parliament, the companies that make balance weights should bear in mind projects that exclude lead from the manufacture of balance weights.

In addition, with the passing of time, the clamp that secures the balance weight close to the wheel may undergo corrosion and detach. As a result, the user will have to resort to companies specializing in balancing, since the installation of said balance weight needs tools and skilled labor to carry out the service, thus causing a cost-and-time drawback.

In addition to the functional drawbacks, the balance weight has the unfavorable esthetic factor. The usual coloration of the balance weight is that of its constituent material, thus being different from the that of the wheel, causing a little attractive contrast with the vehicle. Besides, as already stated, it damages the paint of the wheel on which it is installed due to the friction between it and the flange.

Objectives of the Invention

A first objective of the present invention is to provide a magnetic balance weight for the dynamic balancing of vehicle wheels.

A second objective of the present invention is to provide a wheel having means for fitting the balance weight of the invention.

A third objective of the present invention it to provide a wheel disc for use on the above-mentioned wheel and having means for fitting the balance weight of the invention.

A fourth objective of the present invention is to provide a wheel rim for use on the above-mentioned wheel and having means for fitting the

balance weight of the invention.

Brief Description of the Invention

The first objective of the present invention is achieved by means of a balance weight, especially for use on automotive vehicles, comprising at least one body and at least one magnetic element.

The second objective of the invention is achieved by means of a wheel, especially for use on automotive vehicles, provided with associated rim and disc, comprising an end region that has a free end, the end region having a cavity for association with a balance weight as defined above.

The third objective of the present invention is achieved by means of a wheel rim, especially for use on a wheel of automotive vehicles, comprising an end region that has a free end, the end region having a cavity for association of a balance weight as defined above.

The fourth objective of the present invention is achieved by means of a wheel disc, especially for use on a wheel of automotive vehicles, comprising an end region that has a free end, the end region having a cavity for association of a balance weight as defined above.

The invention has the following advantages, among others:

- the balance weight of the magnetic wheel does not have clamps, which damage the paint of the wheel and may become loose and drop;
- the installation of the balance weight does not need the use of specific tools, thus being easier and less expensive;
- the present invention favors the use of wheels having a surface finish with different degrees of rugosity, including reduced rugosity without loss in the capacity of fixing the balance weight to the wheel;
- still in the area of aesthetics, the balance weight may preferably be painted in the color of the wheel, which "camouflages" it;
- the balance weights of the present invention may be installed either in the groove or at any other point on the wheel, for instance on the inside of the disc, since they are magnetic;

- the weights may be used on prior art wheels.

Brief Description of the Drawings

The present invention will now be described in greater detail with reference to an embodiment represented in the drawings. The figures show:

- Figure 1 is a cross-section view of a wheel flange with a balance weight of the prior art being fixed;

- Figure 2 is a cross-section view of the flange of a wheel that has a cavity for inserting the magnetic balance weight of the present invention;

- Figure 3 is a cross-section view of the wheel illustrated in figure 2 with the magnetic balance weight of the invention fixed to it;

- Figure 4 is a cross-section view of the flange of a wheel from the prior art with a first alternative embodiment of the magnetic balance weight of the present invention; and

- Figure 5 is a cross-section view of the flange of the wheel from the prior art with a second alternative embodiment of the magnetic balance weight of the present invention.

Detailed Description of the Figures

According to a preferred embodiment and as can be seen in figure 2, the wheel of the present invention comprises a cylindrical wheel rim and a substantially circular wheel disc associated to each other.

The wheel rim is provided with at least one end region 1, called a flange, which is protuberant and constitutes a region of maximum diameter of the wheel. The flange 1 has a free end 7 and a body 2, the end 7 projecting from the body 2 substantially parallel to it, defining a substantially "⌉" or "J" shaped profile. Usually, the wheel rims have two flanges 1, located at their two ends, so that both of them enable one to fix and position a tire (not shown) onto the wheel.

Optionally, one may obtain a wheel with a rim that defines one of the flanges 1, and the disc defines the other flange 1, so that, when these components are associated to each other, the functional result is similar to that achieved by the wheel that comprises the two flanges 1.

The two wheel flanges 1 and the rest of the rim wall or disc wall, as the case may be, define a groove in which the tire is placed, so that its side wall close to the opening, usually known as a bead, is propped by the flanges. When the tire is inflated, the force exerted by it and resulting from the compressed air inside it keeps it positioned, preventing any movement of the bead with respect to the flange 1.

The flange has a cavity 3 that defines a notch for the balance weight 4, which is used for dynamically balancing the wheel-tire assembly, preventing trepidation in the vehicle if it is traveling at a high speed as a result of unbalancing.

The cavity 3 is preferably annular, but it may have other shapes or even be segmented. The cavity 3 is provided with side walls 3a, which actuate as latches for the balance weight 4, preventing it from being displaced with the radial movement of the wheel, forcing the balance weight 4 to follow its movement. In this way, the walls 3a generate a centripetal force that helps the magnetic force to keep it correctly installed.

In the preferred embodiment, the cavity 3 has a substantially semicylindrical bottom surface, from which said side walls 3a project, providing a groove shape.

The balance weight 4 of the present invention has two layers, namely:

- a layer 4a, preferably constituted by a metallic material instead of lead, since the use of these balancing weights will be prohibited because lead is a heavy metal that causes damages;

- a layer 4b, constituted by any magnetic material, for fixing the balance weight 4 into the cavity 3.

The balance weight 4 is preferably shaped as an annular segment cooperating with the cavity 3. In the preferred embodiment, as can be seen in figures 2 and 3 the balance weight 4 is fixed into the cavity 3 by means of a magnetic layer 4b, whereby it is secures in a clean and easily usable way.

The cavity 3 guarantees fixation and does not allow the balance

weight 4 to fall out of it while the tire is turning, as already mentioned. Alternatively, the cavity 3 may be provided at any place in the wheel, as for example on the inside of the disc, or it may even not exist.

At present, as we can see in figure 1, the balance weight 400 of the prior art comprises a clamp 500 and body 410, preferably but not compulsorily metallic, the installation of which will be explained below.

The clamp 500 is substantially U-shaped and has a main edge associated to the metal body 410, a second free end and an internal wall surface 600 facing the flange 100 of the prior art wheel when the balance weight 400 is associated to it.

In the prior art, wheel/weigh fixation is effected by means of friction of the internal surface 600 of the clamp 500 with the flange 100, since a movement of the balance weight 400 is forced against the flange 100, which causes the claim 500 to open gradually when the assembly moves, until the metallic body 410 touches the flange body. This movement causes the clamp 500 to be in a forced open position, tending to return to its natural shape, whereby a perpendicular force is applied around the flange surface 100, fixing and keeping the balance weight in the correct position.

The balance weight 4 of the present invention is intended to eliminate some of the drawbacks existing in the prior art cited above. The friction between the balance weight of the prior art and the flange 1, in the installation especially in the case of painted wheels, causes a wear on the paint, scratching and damaging it. In this preferred embodiment, the edges of the balance weight 4 are preferably rounded in order to prevent, as much as possible, damage to the paint in the contact with the cavity 3. The fixing by means of magnetization, besides being an environmentally clean fixation, eliminates the clamp 5. The installation of the balance weight 4 becomes more practical, reducing the cost of labor, since there is no need to use specific tools, which enables one to install it more easily and at a reduced cost.

By eliminating the claim 5, another drawback in the aesthetics of the wheel is also eliminated, improving the visual aesthetics, a requirement which one has been trying to improve more and more lately.

Further in the area of aesthetics, the balance weight 4 may preferably be painted in the same color as the wheel, thus "camouflaging" it.

The balance weights 4 of the present invention may be installed in the groove or at any other point on the wheel, for instance inside of the disc.

Evidently, one may conceive any type of wheel provided with the cavity 3 configuring a notch for the balance weight 4 with a magnetizable layer 4b, not only wheels composed of a rim and a disc and stamped from steel, but also cast wheels, spoked wheels, wheels made from other materials or any other.

The present invention enables one to use wheels with a surface finish having different rugosity, including reduced rugosity. The geometry and thickness of the flange 1 and of the cavity 3 may vary, as well as the size of the balance weight 4, depending upon the size of the wheel to be installed, and even so a wheel configured in this way will continue to be within protection scope of the invention.

This configuration may only be implemented on new wheels that have just come out of the factory. Following the same concept, new alternative configurations of magnetic wheel weight have been developed, which may be used on any type of wheel, as can be seen in figures 4 and 5.

On wheels existing on the market and on those that are presently in use, the change and/or placement of the balance weight 400 should be constantly carried out, due to the poor conditions of the public ways. Since the change of present wheels into wheel with a cavity 3 is inaccessible to many consumers, because of the high price thereof, a first alternative configuration of balance weight 40 has been developed, which use the same concept of the balance weigh 4 disclosed above for use on present-day wheels. As already said, the present-day balance weight 400 is fixed to the wheel flange 100 by friction, and its fixation reliability is limited. On the other hand, the balance weight 40, as can be seen in figure 4, discloses fixation by means of the clamp 5, which is substantially U-shaped, with one of its ends fixed to a preferably but not compulsorily metallic body 4c, the latter being

provided with two layers, the first one 4a being constituted by any material and the second one 4b being constituted by a magnetic material. The present balance weight 40 has also a second end provided with an internal wall 6, analogously fixed to the conventional weights at the free end 7 of the flange 1. The existence of the magnetic layer 4b offers the user greater reliability in fixing the balance weight 40, since in addition to the usual fixation by means of the clamp 5 the metallic body 4c will be magnetically fixed to the flange 1 by the layer 4b.

Preferably, the balance weight 4 and the magnetic body 4c are constituted by lead with application of a layer 4b of ferromagnetic material. However, when the prohibition of use of lead for making balance weight goes into force, the preferred material will be steel, by virtue of its abundance, low cost and relatively high specific weight, or another material having characteristics similar to those of steel and compatibility with the magnetizable layer.

Figure 5 discloses a second alternative embodiment of the balance weight 40', wherein the clamp 5 has two layers, a first one 5a being constituted by any material (preferably metallic) and a second one 6a being constituted by a magnetic material. The balance weight 40' will be fixed by means of the clamp in procedure already commented, in addition to the magnetic force applied by the second layer 6a close to the end 7 of figure 1, thus strengthening the fixation of the balance weight 30 to the wheel.

Moreover, both the clamp 5 and the balance weight 4 may be jointly provided with a magnetizable layer 6a, 4b, achieving an even more satisfactory result in fixing the balance weight 40, 40', or else any other desired configuration may be foreseen. The balance weight 40, 40' may be used on any wheel of the prior art, as well as on the preferred embodiment. And the magnetized weight 4 of the preferred embodiment may be installed and used on the wheel of the prior art, or any other type of wheel of an automotive vehicle, or else any other necessary or desirable combination.

The invention may be additionally used for balancing other wheels or substantially circular or non-circular bodies that are not compulsorily used for automotive vehicles.

Examples of preferred embodiments having been described, it should be understood that the scope of protection of the present invention embraces other possible variations, being limited only by the contents of the accompanying claims, which include the possible equivalents.